

PATENT COOPERATION TREATY

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From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:
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PCT

NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of Mailing
(day/month/year)

16 AUG 2004

Applicant's or agent's file reference

HSE-058PC

IMPORTANT NOTIFICATION

International application No.

PCT/US03/25041

International filing date (day/month/year)

08 August 2003 (08.08.2003)

Priority date (day/month/year)

08 August 2002 (08.08.2002)

Applicant

ZTEK CORPORATION

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.
4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/US

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Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

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Form PCT/IPEA/416 (July 1992)

Authorized officer

John S. Maples

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LAHIVE & COCKFIELD
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PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference HSE-058PC	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/US03/25041	International filing date (day/month/year) 08 August 2003 (08.08.2003)	Priority date (day/month/year) 08 August 2002 (08.08.2002)
International Patent Classification (IPC) or national classification and IPC IPC(7): H01M 8/06, 12/06; B60K 1/00 and US Cl.: 429/17, 21; 180/65.1		
Applicant ZTEK CORPORATION		
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>5</u> sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of <u>4</u> sheets.</p>		
<p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the report</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input type="checkbox"/> Non-establishment of report with regard to novelty, inventive step and industrial applicability</p> <p>IV <input checked="" type="checkbox"/> Lack of unity of invention</p> <p>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input checked="" type="checkbox"/> Certain defects in the international application</p> <p>VIII <input type="checkbox"/> Certain observations on the international application</p>		
Date of submission of the demand 04 February 2004 (04.02.2004)	Date of completion of this report 03 August 2004 (03.08.2004)	
Name and mailing address of the IPEA/US Mail Stop PCT, Attn: IPEA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230	Authorized officer John S. Maples Telephone No. 571-272-1700	

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US03/25041

I. Basis of the report

1. With regard to the elements of the international application:*

- ☐ the international application as originally filed.
- ☒ the description:
pages 1-11 _____ as originally filed
pages NONE _____, filed with the demand
pages NONE _____, filed with the letter of _____.
- ☒ the claims:
pages NONE _____, as originally filed
pages NONE _____, as amended (together with any statement) under Article 19
pages NONE _____, filed with the demand
pages 12-15 _____, filed with the letter of 27 May 2004 (27.05.2004)
- ☒ the drawings:
pages 1-2 _____, as originally filed
pages NONE _____, filed with the demand
pages NONE _____, filed with the letter of _____.
- ☐ the sequence listing part of the description:
pages NONE _____, as originally filed
pages NONE _____, filed with the demand
pages NONE _____, filed with the letter of _____.

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language _____ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in printed form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☒ The amendments have resulted in the cancellation of:

- ☒ the description, pages NONE
- ☒ the claims, Nos. NONE
- ☒ the drawings, sheets/fig NONE

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. _____

PCT/US03/25041

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

- ☐ restricted the claims.
- ☒ paid additional fees.
- ☐ paid additional fees under protest.
- ☐ neither restricted nor paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention is accordance with Rules 13.1, 13.2 and 13.3 is

- ☐ complied with.
- ☒ not complied with for the following reasons:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-8, 14-18, drawn to a power supply system.

Group II, claims 9-13, drawn to a method of charging a metal-air converter.

Group III, claims 19-21, drawn to a method of propelling a vehicle.

Group IV, claims 22-24, drawn to an electrically-powered vehicle.

The inventions listed as Groups I-IV do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: Groups I and IV do not include the step of converting the metal oxide back to the metal as do the Group II and III claims. Group I comprises a generator which is not part of the claims of Group IV. In addition, the Group IV vehicle must have the capacity to travel over 300 mile, which limitation is not part of the Group I system. Finally, Groups II and III are different because Group II is drawn to a method of charging a converter while Group III is directed to a method of propelling a vehicle; two materially different processes requiring different steps.

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

- ☒ all parts.
- ☐ the parts relating to claims Nos. _____

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/US03/25041

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. STATEMENT

Novelty (N)	Claims <u>1-24</u>	YES
	Claims <u>NONE</u>	NO
Inventive Step (IS)	Claims <u>1-24</u>	YES
	Claims <u>NONE</u>	NO
Industrial Applicability (IA)	Claims <u>1-24</u>	YES
	Claims <u>NONE</u>	NO

2. CITATIONS AND EXPLANATIONS

Claims 1-24 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest the power supply system for powering an electric motor in an electric vehicle comprising a generator that converts a fuel to electricity, a metal-air converter coupled to the motor and the generator to receive electricity from the generator and a fuel supply to supply the generator with fuel. In addition, the prior art does not teach or fairly suggest an electrically-powered vehicle that has a metal-air converter powered by an on-board energy source, which converter powers a motor for driving the vehicle and wherein the vehicle can travel more than 300 miles without requiring recharging.

Claims 1-24 meet the criteria set out in PCT Article 33(4), and thus the claimed power supply system/method of propelling a vehicle/electrically-powered vehicle possesses industrial applicability because the subject matter claimed can be made or used in industry.

----- NEW CITATIONS -----

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US03/25041

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

Claim 24 is objected to under PCT Rule 66.2(a)(iii) as containing the following defect(s) in the form or contents thereof: this claim depends upon itself and so is objected to.

Claims**REPLACED BY
ART 34 AMDT**

1. A power supply system for powering an electric motor in an electric vehicle, the system comprising:
 - a generator for converting a fuel to electricity,
 - a metal-air converter electrically coupled to the electric motor and the generator for receiving electricity produced by the generator, and
 - a fuel supply for supplying fuel to the generator.
2. The power supply system of claim 1, wherein the metal-air converter comprises one of a zinc-air battery, an aluminum-air battery, a magnesium-air battery, a lithium-air battery, a calcium-air battery and an iron-air battery.
3. The power supply system of claim 1, wherein said metal-air converter is adapted to be operated:
 - as a rechargeable battery for receiving electricity from the generator;
 - as a rechargeable battery for receiving electricity from an off board electric source; and
 - as a fuel cell with replenished metal fuel.
4. The power supply system of claim 1, wherein the generator is selected from a group consisting of a fuel cell, a combustion engine, a gas turbine, and combinations thereof.
5. The power supply system of claim 1, wherein the generator comprises a hybrid power source including a gas turbine and a fuel cell.
6. The power supply system of claim 4, wherein said fuel cell is selected from a group including solid oxide, solid state, molten carbonate, phosphoric acid and alkaline and proton electrolyte membrane fuel cells.

**REPLACED BY
ART 34 AMDT**

7. The power supply system of claim 1, wherein the metal-air converter has an energy density greater than 200 Wh/kg or 500 Wh/l and power density greater than 200 W/kg or 500 W/l.
8. The power supply system of claim 1, wherein the generator produces power in excess of the needs for metal-air converter recharging or on board use and can offer power for off board use.
9. A method of charging a metal-air converter in an electrically-powered vehicle, comprising the steps of:
 - producing electricity using an on-board generator, and
 - applying the electricity from the generator to the metal-air converter to convert a metal oxide produced by the metal-air converter to a metal fuel.
10. The method of claim 9, wherein the metal-air converter powers an electric motor on the electrically-powered vehicle.
11. The method of claim 9, wherein the step of producing electricity comprises electrochemically converting a generator fuel to electricity.
12. The method of claim 11, further comprising the step of supplying the generator fuel to the generator.
13. The method of claim 9, further comprising the step of receiving a supply of the metal fuel from an off-board source.
14. A vehicle propulsion system for an electric vehicle, comprising:
 - an electric motor for driving a vehicle drive train of the electric vehicle;
 - a metal-air converter coupled to the motor for powering the motor; and
 - a generator coupled to the metal-air converter for recharging the metal-air converter and for providing power to the motor, wherein the electric motor, the metal-air converter and the generator are interconnected.

15. The vehicle propulsion system of claim 14, wherein the metal-air converter comprises one of a zinc-air battery, an aluminum-air battery, a magnesium-air battery, a lithium-air battery, a calcium-air battery and an iron-air battery.
16. The power supply system of claim 14, wherein the generator is selected from a group consisting of a fuel cell, a combustion engine, and a gas turbine.
17. The power supply system of claim 14, wherein the generator comprises a hybrid power source including a gas turbine and a fuel cell.
18. The power supply system of claim 16, wherein said fuel cell is selected from a group including solid oxide, solid-state, molten carbonate, phosphoric acid and alkaline and proton electrolyte membrane fuel cells.
19. A method of propelling a vehicle, comprising the steps of:
converting a metal fuel to a metal oxide, wherein the step of converting the metal fuel releases electrons to produce electricity;
applying the electricity to an electric motor to drive a motor vehicle drive train;
and
reconverting back at least a portion of said metal oxide to metal fuel by applying an electric charge from an on-board generator to the metal oxide.
20. The method of claim 19, wherein the metal fuel comprises one of zinc, aluminum, magnesium, lithium, calcium and iron.
21. The method of claim 19 further comprising the step of supplying a generator fuel to the on-board generator, wherein the generator converts the generator fuel to the electric charge.
22. An electrically-powered vehicle, comprising:
a motor for driving the vehicle; and
a rechargeable battery with an on-board energy source for powering the motor,

REPLACED BY
ART 34 AMDT

wherein the vehicle can travel a distance of more than three hundred miles before requiring recharging of the battery from an off-board source.

REPLACED BY
ART 34 AMDT

23. The vehicle of claim 22, wherein the rechargeable battery comprises a metal-air converter.

24. The vehicle of claim 22, wherein the on-board energy source comprises a generator and a fuel supply.

25. The vehicle of claim 24, wherein the generator is selected from a group consisting of a fuel cell, a combustion engine, a gas turbine and combinations thereof.